

CLAIMS

1. A method of processing image data of a plurality of time-separated images of a non-rigid body to detect movement of the body, comprising the steps of:-  
5 for each of a plurality of sampling points in each image calculating and storing a plurality of candidate movements together with the estimated probability of each candidate;

iteratively recalculating for each sampling point the probability of each of the candidate movement based on the stored probability of that candidate movement and  
10 the probabilities of the candidate movements at other sampling points; and generating from the recalculated probabilities a motion field indicative of the non-rigid body movement.

2. A method according to claim 1, wherein the other sampling points are  
15 the neighbouring sampling points.

3. A method according to claim 1 or 2, wherein the sampling points correspond to unit areas containing a set of pixels of the image.

20 4. A method according to claim 1, 2 or 3, wherein the plurality of candidate movements and their probabilities are calculated by calculating a similarity measure indicating the similarity of each sampling point to sampling points in the preceding image, and normalizing the similarity measures to sum to unity, the normalised similarity measures being stored as said probabilities, and the candidate  
25 movements are the corresponding vector displacements which map the sampling point to the respective sampling points in the preceding image.

5. A method according to claim 4 wherein the similarity measure is selected from mutual information, normalised mutual information, entropy  
30 correlation coefficient and centered cross correlation.

6. A method according to any one of the preceding claims, wherein the iterative recalculation of the stored probabilities comprises multiplying each stored probability by the product of the stored probabilities for the neighbouring sampling points.

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7. A method according to claim 6 wherein the iterative recalculation of the stored probabilities comprises multiplying each stored probability by the product of the respective maxima of the stored probabilities for the neighbouring sampling points.

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8. A method according to claim 6 wherein the iterative recalculation of the stored probabilities comprises multiplying the stored probability for each candidate movement at each sampling point by the product of the respective maxima of the stored probabilities for the neighbouring sampling points, the maxima being weighted according to the difference between said candidate movement and the respective stored movements corresponding to the maxima.

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9. A method according to claim 8 wherein the weighting is Gaussian.

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10. A method according to any one of the preceding claims wherein the iterative recalculations of the probabilities for the movements at each sampling point use only movements at neighbouring sampling points which are judged to be similar to the said movements at each sampling point.

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11. A method according to claim 10 wherein movements are judged to be similar if the difference in magnitudes of the displacements caused by the movements is less than a preset amount.

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12. A method according to any one of the preceding claims wherein the number of iterations is set according to the distance between salient points in the image.

13. A method according to any one of the preceding claims wherein the motion field is generated by selecting as the movement at each sampling point the candidate movement having the maximum probability after said iterative recalculation.

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14. A method according to claim 13 further comprising the step of correcting the plurality of images for the movement by applying thereto a transformation based on the motion field, and then repeating the method of claim 13 using differently spaced sampling points to generate a new motion field.

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15. A method according to claim 14 wherein the transformation is calculated by fitting a parametric transformation to the motion field.

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16. A method according to claim 14 or 15 wherein the steps of correcting the plurality of images for the movement and then repeating the method of claim 13 using differently spaced sampling points, are carried out iteratively with successively more closely spaced sampling points.

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17. A method according to any one of the preceding claims wherein the images are a sequence of magnetic resonance images of a body taking up a contrast agent.

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18. A method according to any one of the preceding claims wherein the images are a sequence of magnetic resonance images of a human breast taking up a contrast agent.

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19. Apparatus for processing image data of a plurality of time-separated images of a non-rigid body to detect movement of the body, comprising:  
calculating means for calculating for each of a plurality of sampling points in each image a plurality of candidate movements together with the estimated probability of each candidate;

storage means for storing said candidate movements and estimated probabilities;

recalculating means for iteratively recalculating for each sampling point the probability of each of the candidate movement based on the stored probability of that candidate movement and the probabilities of the candidate movements at other  
5 sampling points; and

motion field generating means for generating from the recalculated probabilities a motion field indicative of the non-rigid body movement.

10 20. A computer program storage medium readable by a computer system and encoding a computer program for controlling a computer to process image data of a plurality of time-separated images of a non-rigid body to detect movement of the body by a method comprising the steps of:-

for each of a plurality of sampling points in each image calculating and  
15 storing a plurality of candidate movements together with the estimated probability of each candidate;

iteratively recalculating for each sampling point the probability of each of the candidate movement based on the stored probability of that candidate movement and the probabilities of the candidate movements at other sampling points; and

20 generating from the recalculated probabilities a motion field indicative of the non-rigid body movement.

21. A method of processing image data substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

25 22. Apparatus for processing image data constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

30 23. A computer program storage medium readable by a computer system and encoding a computer program for controlling a computer to process image data by a method substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.